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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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EXAMINER

JOHNSTON, PHILLIP A

ART UNIT	PAPER NUMBER
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2881

DATE MAILED: 04/23/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/082,288

Applicant(s)

SATO ET AL.

Examiner

Phillip A Johnston

Art Unit

2881

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 12 February 2003.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1,2,4-10,15-19 and 22-30 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

- 5) ☐ Claim(s) _____ is/are allowed.

- 6) ☒ Claim(s) 1,2,4-10,15-19 and 22-30 is/are rejected.

- 7) ☐ Claim(s) _____ is/are objected to.

- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 26 February 2002 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892) 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 5,8. 6) ☐ Other: _____

Detailed Action

Examiners Response to Arguments

1. Applicants arguments are moot in view of new grounds for rejection.

Claims Rejection – 35 U.S.C. 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which the subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

3. Claims 1,2,4-10,15-19, and 22-30 as amended are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 5,627,373, to Keese, in view of Watanabe, U. S. Patent No. 6,333,510.

Regarding Claims 1,4-7,15, and 22-24, Keese (373) discloses scanning electron microscope 10 includes a housing 12 which defines an evacuated sealed column. A vacuum is maintained inside the column. An electron gun 14 is located at the top of

Art Unit: 2881

the housing 12. Condenser lenses 19, 20 include one or more beam alignment coils 22 respectively, for aligning the electron beam and for condensing the beam into a spot approximately 10 nanometers (nm) or less across. Condenser lenses 19 and 20 align the electron beam in response to lens control signals LC1 and LC2, respectively.

An astigmatism coil 25 adjusts radial uniformity of the electron beam for correcting electron beam astigmatism. Astigmatism coil 25 is controlled by astigmatism coil control signal ASC. Scan coils 26 deflect the electron beam in a raster scan pattern on the surface of specimen S in response to scan coil control signals SC1, SC2, SC3, and SC4. An objective lens 28 has beam focusing coils for focusing the electron beam on specimen S in response to objective lens control signal OC. Objective lens 28 has an objective lens axis A_0 .

The electron beam impinging on the specimen causes the specimen to emit secondary electrons from the specimen S surface. The accelerated secondary electrons strike a fluorescent target (e.g., scintillator) 34. When struck, the scintillator 34 emits a flash of light. A flash detector 36 detects the light and converts the flash of light to an electrical pulse signal FD. A display device 32 displays a stream of electrical pulses FD as bright or dark areas, and builds up an image of specimen S line-by-line. Each emitted light flash corresponds to a surface feature of specimen S and is used to define an image portion of such feature. See Column 4, line 25-67; Column 5, line 1-23, and Figure 1.

Keese (373) also discloses a computer 40 for monitoring and controlling microscope 10. Computer 40 includes a user interface 42, a video circuit 44, and an imaging processing circuit 46 that includes a pattern recognition circuit 48 and a control circuit 50. Computer 40 is coupled to provide scan coil control signals SC1, SC2, SC3, and SC4 to scan coils 26 for synchronizing the scan pattern of the electron beam with a raster scan pattern on display device 32. Computer 40 is coupled to provide control signals ASC, LC1, LC2, and OC in response to user-generated commands entered at user interface 42. Pattern recognition circuit 48 is coupled to provide a signal IND to control circuit 50. Pattern recognition circuit 48 analyzes signal FD for imaged features of specimen S, such as position in the field of view and sharpness of the edge image. For example, in one embodiment pattern recognition circuit 48 determines the absolute value of the peak first derivative of the smoothed image intensity of each raster scan line and derives an average over all scan lines. This information is contained in signal IND provided to control circuit 50. Control circuit 50 stores and analyzes signals IND, and calculates corrections to beam alignment and astigmatism. Control circuit 50 generates control signals LC1 and LC2 for automatically correcting beam alignment, and generates control signal ASC for automatically correcting beam astigmatism. See Column 5, line 24-54.

Keese (373) further discloses the use of a magnified edge of the entrance aperture to the Faraday cup, which is imaged along a first axis substantially orthogonal to the electron beam axis. The magnified edge provides a strong step function in signal intensity and appears as a substantially straight edge at a first directional

orientation. The focus of the objective lens is varied between extremes of the focus range. A pattern recognition circuit analyzes the image of the substantially straight edge and generates signals for indicating the straight edge position in the field of view of the image at the extremes of the focus range. A control circuit stores and compares the edge image position indicator signals to determine image translation of the straight edge for the two extremes. In response alignment coil control signals are generated for adjusting electron beam alignment. Another portion along the aperture perimeter is imaged to define a second image sample having a straight edge oriented along a second axis that is substantially orthogonal to both the first axis and the electron beam axis. The image translation analysis and alignment then is repeated for the second image sample. The process repeats iteratively for image samples defining straight edges at successive 90° angular offsets, and stops when the pattern recognition circuit detects substantially no translation of a straight edge at two extremes of the focus range. See Column 2, line 59-67; and Column 3, line 1-15.

It is implied herein, that utilization of computer 40 to automatically correct beam alignment and beam astigmatism in accordance with Keese (373) above, is equivalent to "obtaining the alignment condition based on the calculated unknown and a condition in which an image deviation becomes small when the convergence condition of the objective lens is changed to the two condition", as recited in Claims 1 and 24.

Regarding Claims 2, and 8-10, Keese (373) further discloses the use of a circular entrance aperture to a Faraday cup as a specimen having a high contrast feature

which is sampled to obtain sample images defining straight edges at successive angular offsets about the aperture circumference. The magnified edge of the aperture provides a strong step function in signal intensity enabling each sample image to appear with a substantially straight edge. A pattern recognition circuit analyzes the image of the magnified straight edge of a given sample image and generates a signal for indicating the sharpness of the magnified edge image. A control circuit stores the indicator signal. The specimen is imaged at different locations on the circular aperture, and the sharpness of the imaged edge is determined at different angles where the beam scan intersects the edge. A sharpness indicator signal for each angle is generated and provided to the control circuit for storage. In one embodiment, the imaging is performed at regular intervals, such as 30.degree., along the entire aperture circumference (i.e., 360.degree.). The control circuit then compares the edge sharpness indicator signals for each image angle. The results for each angle are compared to determine which angle among the 360⁰ is an axis of highest beam distortion. Once this axis is determined, the control circuit generates astigmatism coil control signals for compressing the beam along such axis. The astigmatism control signal magnitude then is indexed and the process repeated iteratively until the axis of highest beam distortion is less than a threshold value. When such condition is reached, the electron beam is considered to be substantially radially uniform. See Column 3, line 18-46.

Regarding Claims 25-30, Keese (373) discloses that the Faraday cup is repositioned along x and y axes via stage 18 to image a second position 68' on the aperture 60 edge which is 90 degrees offset from the first aperture point 68 imaged. After repositioning, the edge is imaged. FIG. 8 shows an image of the second sample edge. Such second sample edge is oriented along an axis orthogonal to both the first axis (e.g., the y axis) and the electron beam axis A_e . In the case shown, the straight edge boundary portion 68 for the second sample is oriented along the x axis. The order of imaging an edge(s) along first and second orthogonal axes may vary. The beam alignment process of detecting image translation and adjusting alignment as described above is repeated for the second sample image and any subsequent sample images. The alignment proceeds in an iterative manner taking images of edges at progressive 90^0 offsets. The iterations stop when the difference in magnitude of the location indicator signals IND for extremes of focal range for a current sample image and previous sample image are less than a prescribed threshold improvement. The prescribed threshold preferably is proportional to the pixel width of display device 32, the magnification of the sample edges. The prescribed threshold varies for a given system and magnification. An exemplary threshold for a system with approximately 500 pixels in each axis, at 100,000 X magnification, and with each pixel approximately 10 nanometers in each dimension, is 5 pixels, or 50 nanometers. See Column 7, line 11-36.

Keese (373) as applied above does not disclose the use of "means for detecting centers of gravity in the patterns of two images obtained; and means for calculating a

deflection amount of the alignment deflector based on a deviation between the centers of gravity of the two patterns.”, as recited in Claim 30. However, Wagner (172) discloses, that the most basic attribute is the defect location which is set to be the center of gravity of the constituent pixels of the defect. Other examples of attributes are defect size, the number of pixels making up the defect, and defect boundary, the convex hull of the pixels making up the defect. The method of comparison followed by cross-check between perspective images can be exploited to calculate yet further attributes of defects such as whether the defect is above or below the wafer pattern. All these attributes can be used subsequently for defect classification.

Therefore it would have been obvious to one of ordinary skill in the art that the Keese (373) alignment and astigmatism correction apparatus and method can be modified to use the center of gravity reference point for image comparison in accordance with Wagner (172), if so desired.

Conclusion

4. The Amendment filed on 2-19-2003 under 37 CFR 1.131 has been considered but is ineffective to overcome the references cited above.


Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

5. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Phillip A Johnston whose telephone number is 305 7022. The examiner can normally be reached on 7:30 to 4:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, John R Lee can be reached on 703 308 4116. The fax phone numbers for the organization where this application or proceeding is assigned are 703 872 9318 for regular communications and 703 872 9319 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703 308 0956.


JOHN R. LEE
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2800